ABSTRACTS

SUMMARIZING RECENTLY COMPLETED AND ON-GOING CERULEAN WARBLER RESEARCH

PRESENTED AT

CERULEAN WARBLER WORKSHOP
17 DEC 2002

NATIONAL CONSERVATION TRAINING CENTER
SHEPHERDSTOWN, WV

Spatial Distribution and Habitat Associations of Cerulean Warblers at West Point, New York

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We conducted surveys to document the distribution and habitat associations of Cerulean Warblers (CERW) on the 6500-hectare West Point Military Reservation (WPMR). We implemented two basic survey designs: a systematic sample (205 points spaced at 500-m intervals) to ensure even spatial coverage of the WPMR, and a habitat-based sample (206 points in forest type patches randomly selected from a vegetation map of WPMR), to ensure that all forest types that CERW might occupy were sampled. We conducted 10-min counts of birds heard or seen at all points, recording estimated distance and direction to each CERW detected, and listening an additional 5 min for CERW response to the CEWAP audio-tape of recorded song at points where CERW had not previously been detected.

The data were used in a stepwise logistic regression analysis, where the response variable was binary (CERW present or not detected) and the explanatory variables were those that could be measured in Arc/Info. CERW presence was significantly associated with distance to nearest lake, patch area, and the maple-beech community type. Using these variables, we calculated the predicted probabilities of occurrence for CERW throughout the WPMR, and mapped them using the GRID module of Arc/Info. To increase the probability of documenting locations of all CERW territories on the WPMR, we added points to the grid of systematic points during the second year of the survey, so that points were spaced at 250-m intervals in areas where the predicted probability of occurrence for CERW was ≥ 0.1 (487 total points). This approach enabled us to roughly double the number of CERW males located in the second year of survey (n > 40, though some males were likely detected at >1 point and others did not remain on territory through the nesting season). The locations of CERW males were generally clustered, and, surprisingly, several clusters were collocated with field staging or training areas actively used by U.S. Military Academy cadets from late June onward.

We also conducted observations of >30 CERW males to document the tree species and sizes used, and measured habitat characteristics within 0.04-ha circles in CERW male activity centers, at an equal number of points not used by CERW, and around the few CERW nests that we located. Analysis of those data has not yet been completed.

Jason Jones, Jenn J. Barg, and R. J. Robertson. CERW at QUBS.

Cerulean Warbler research at the Queen's University Biological Station (QUBS), Ontario, Canada (44º34' N, 76º20' W) began in 1993. QUBS is located within the Great Lakes-St. Lawrence mixed forest region. Our main study area (hereafter referred to as Bedford) is within the approximately 2600 ha of research tracts managed by QUBS. Within these tracts, deciduous forest is the dominant habitat type. Most research activities are carried out on one study grid (~ 25 ha). Between 20 and 30 pairs of Cerulean Warblers occupy the site each year. The forest in the study site is characterized as mature, secondary-growth, upland mixed deciduous with a canopy layer predominated by sugar maple (Acer saccharum), and to a lesser extent oak (Quercus spp.) and elm (Ulmus spp.). The average height of the forest canopy (22 m) at our main site is lower than the average nest height for Cerulean Warblers in other parts of its breeding range.

At the scale of the forest patch, we have discovered that Cerulean Warblers occupy and breed in small forest fragments (<50 ha) embedded in the largely agricultural matrix that surrounds QUBS and often will incorporate forest-field edges into their territories. It is our sense that Cerulean Warblers may not be as sensitive to forest area in eastern Ontario as they appear to be in other parts of their range. However, we have not had the opportunity to assess reproductive success of birds occupying territories in many of these small fragments.

At Bedford, we have determined that territory selection by male Cerulean Warblers is non-random; territories (0.5-2.0 ha) tend to be characterized by large, well-spaced trees with distinct, dense canopies. Males show strong territory fidelity both between and within years. Within these territories, nest-site selection is also non-random but the habitat selectivity at this spatial scale (i.e. the magnitude of the differences between selected and non-selected habitats) was much weaker than at the scale of territory selection. One implication of these results is that there are stronger selective pressures acting at the territory scale. Another is that males are selecting territories on the basis of providing multiple potential nest-sites; the presence of multiple suitable sites with territory boundaries would limit our empirical ability to differentiate between nest and non-nest habitats.

More recently, we have begun further investigations of within-territory habitat use in greater detail. The goals of this project were: (1) to describe the internal spatial and habitat structure of Cerulean Warbler territories, and (2) to determine the behavioral significance of areas of high use (core areas) within territory boundaries. The results of this work indicate a possible interaction between extra-territorial factors (e.g., density of surrounding pairs) and within-territory habitat use by males. Males exhibit significantly non-random patterns of space use within their territories and these patterns do not appear to be linked to within-territory needs. For example, core areas within male Cerulean Warbler territories appear to serve as singing centers but their location within a territory implies that either: (a) males may be more interested in communicating with females other than their social mate than in remaining vigilant over their own nest-sites; or (b) core areas are chosen based on specific habitat characteristics that allow male song to travel farther and retain its structure on the way to intended receivers.

We have had great success over the last eight years catching and marking individual birds (n > 120), finding nests (n = 211), and documenting reproductive success. In fact, we are usually able to find nests for >90% of breeding pairs in a given season at our main study site. This prior success presents an important obligation to continue our investigations into Cerulean Warbler ecology and life history, in order to provide information that could be critical to the health of this species across its breeding range.

Contact: Amanda Rodewald, School of Natural Resources, The Ohio State University

1. **Avian post-fledging habitat use of regenerating clearcuts (southeast Ohio).** Andrew Vitz and Amanda Rodewald.
   - Research Objectives: a) identify the relative abundance and species composition of birds utilizing early successional forests during the post-fledging period, b) determine if stand area or stand age is related to avian use of early successional habitats, c) evaluate if post-fledging use of early successional habitats is most closely associated with habitat structure, fruit resources, or arthropod resources, and d) compare use of early successional habitats by HY and AHY birds.
   - Approach: Mist-netting and banding, sampling of fruit, arthropod, and vegetation.
   - Results: Post-breeding and juvenile Scarlet Tanager, Wood Thrush, Worm-eating Warbler, and Red-eyed Vireo were frequently captured within clearcuts. Two hatch-year Cerulean Warblers also were captured in the clearcuts. In addition, Cerulean Warblers were frequently heard singing near the clearcut/mature forest boundary suggesting that they were not avoiding this type of edge. Preliminary analysis suggests that small (<10 ha) regenerating clearcuts within a forested landscape are heavily used by many mature forest breeders during the post-fledging period.

2. **Influence of landscape composition on bird communities in forested landscapes (central Pennsylvania).** Amanda Rodewald and Richard Yahner.
   - In this study, we predicted that agricultural disturbances within forested landscapes had a greater influence on avian community structure than silvicultural disturbances. In addition, we investigated whether the spatial extent of disturbance was more important than or interacted with the type of disturbance within forested landscapes. Three potential underlying mechanisms responsible for landscape associations with avian community structure were investigated: 1) variation in microhabitat, 2) variation in microclimate, and 3) variation in nesting success.
   - Approach: Avian surveys, nest monitoring, habitat measurements.
   - Relevant findings: (1) Cerulean Warblers were more likely to occur in forested landscapes disturbed by silviculture than forested landscapes disturbed by agriculture (Rodewald 2000, PhD dissertation; Rodewald and Yahner 2001, Ecology 82:3493-3504) and (2) male Ceruleans used even-aged harvests (< 5 years old) containing residual trees at about 100 trees/ha (Rodewald and Yahner 2000, Journal of Wildlife Management 64:924-932). Anecdotally, CERW males also regularly sang around the periphery of the harvests in uncut forest (within ca. 5-30 m from the harvest edge). Although I haven't analyzed the habitat-bird data in this way, CERWs were most common on unharvested sites that contained large natural treefall gaps (with trees >38cm dbh recently fallen).

3. **Landscape-scale impacts of timber harvesting on mature forest bird communities (early planning stages in southern Ohio).** Amanda Rodewald
   - Objectives: a) evaluate how harvest size, landscape context, and harvest edges affect abundance and community structure of mature-forest associated bird species (including CERW) and b) examine the effect of mature forest – regenerating harvest interfaces on the density and productivity of focal species (including CERW).
   - Expected Approach: surveys, spot-mapping, target-banding, nest-monitoring, and habitat measurements

Science Support For Regional And Refuge Bird Conservation Planning: Modeling Avian-Landscape Habitat Associations.

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Federal and state land management agencies and non-profit organizations interested in birds would like to be able to identify habitats important to birds. They also would like the ability to predict where high priority species are likely to occur and whether current management actions will sustain populations of high priority species on public land management units. Thus, our objective is to develop spatially explicit predictions of regional relative abundance for species of high management concern. One species we are focusing on is the Cerulean Warbler.

We developed a hierarchical model estimating spatially referenced indices of population abundance from the North American Breeding Bird Survey for Bird Conservation Region 23 (BCR23; an area of the Upper Midwest stretching from central Minnesota to central and southern Michigan). The model is Bayesian, allowing treatment of some parameters as random variables. The model takes the form of an over-dispersed Poisson regression, accommodating nuisance effects associated with observers and potential spatial autocorrelation in counts. Environmental variables such as land cover composition and configuration, landform heterogeneity, climate, and potential human disturbance are included as fixed effects. We used Markov Chain Monte Carlo methods to fit the model.

We began with an *a priori* model based on a review of the literature and through consultation with an expert on the species. We supplemented this *a priori* model with a post-hoc exploratory analysis, whereby we evaluated >200 environmental variables with classification and regression trees. Our final models suggested Cerulean Warblers are most abundant in dry, deciduous forests within moist landscapes. Our modeling approach explained ~32% of the variation in CERW abundance, a large part of which was due to the particular spatial structuring of the model. Mapping of Cerulean Warbler abundance for BCR23 is ongoing.